

**EPA DRAFT RESPONSES TO HONOLULU BOARD OF WATER SUPPLY
RED HILL MWIWP COMMENTS
June 6, 2016**

BWS Comment #1:

Section 1.2.1.4 *Groundwater* should be revised to explain that perched groundwater, implications of which are discussed in Section 3.2 *Drilling*, is present at many locations, including the basalt and valley fill units in the Red Hill vicinity. The explanation should include what is known about perched water occurrences at Red Hill.

Regulatory Agency Response:

The Regulatory Agencies agree with this comment.

BWS Comment #2:

The *Groundwater* sub-section should be revised to explain that the basal aquifer beneath the Red Hill Bulk Fuel Storage Facility (RHBFSF) was designated as a Sole Source Aquifer in 1987 under Section 1424(e) of the Safe Drinking Water Act.

EPA Response:

The fact that the basal aquifer is a sole source aquifer has no bearing on the MWIWP.

BWS Comment #3:

Section 2.2 Step 2-Identify the Study Objectives states that a"... secondary objective is evaluate the nature of petroleum product and constituent chemicals in soil, if present in the vadose and saturated zones underlying and downgradient of the tanks." The proposed well locations are far from the tanks and will only provide any information about fuel contamination in the vadose zone materials "underlying and downgradient" of the tanks if the fuel has migrated long distances laterally from the tanks. Thus the proposed well locations will not likely achieve this important objective and will likely fail to achieve the goal stated in the second sentence of Section 2.1: "Additional monitoring wells are proposed to allow for monitoring the potential migration of light non-aqueous phase liquid (LNAPL) to the groundwater, ... ". The MWIMP should be revised to include drilling, coring, and installation of vadose zone monitoring wells much closer to the tanks to determine the nature, extent, and migration of fuel contamination in the vadose zone because

1. The roughly 30,000 gallons of fuel released in January 2014 have not yet been mapped out in the sub-surface; and,
2. This large quantity of fuel will likely serve as a continuous source of contamination to our drinking water for years to come.

EPA Response:

The purpose of the MWIWP is the installation of wells to monitor groundwater to determine if contamination in the ground is migrating away from the facility. The secondary objective is established so that if contamination is encountered during drilling of the wells it will not be simply ignored, but analyzed. The BWS suggestion that additional wells need to be installed closer to the facility in order to characterize potential contamination in the vadose zone is outside the purview of this plan. Development of the conceptual site model, which is what BWS is suggesting, is part of the Section 6&7 Scope of Work.

BWS Comment #4:

Section 2.3 Step 3-Identify the Information Inputs states that groundwater elevation data will be obtained. This text should be revised to explain that a high-quality survey, such as the first order survey mentioned by Dr. Delwyn Oki of the United States Geological Survey (USGS) during the most recent AOC SOW meeting, will be necessary to obtain sufficient accuracy of groundwater elevations.

EPA Response:

EPA agrees with this comment from BWS and will include it in their comments on the MWIWP, but as a comment on section 3.5 Surveying.

BWS Comment #5:

Figure 2, which depicts the proposed locations of the new monitoring wells, includes an arrow showing the direction of regional groundwater flow to be roughly south-southwest. This arrow is misleading and should be removed because there is no direct evidence to support such a flow direction.

EPA Response:

The Regulatory Agencies agree with this comment and have already noted that placement of the arrow on Figure 2 is misleading.

BWS Comment #6:

The third bullet item in Section 2.5 Step 5-Develop the Analytic Approach should be revised to clarify what will be done if "soil is present below the bottom of the tanks". The material below the tank bottoms is likely to be basalt, not soil and none of the proposed wells will intercept the material directly beneath the tanks.

EPA Response:

The Regulatory Agencies have a different interpretation of this bullet, but we acknowledge that it is unclear. The statement should read "If soil is present at elevations *lower than the bottom of the tanks elevation* or if contaminated soil is encountered, then obtain soil samples and analyze their chemical and geotechnical properties. It is obvious from the proposed well locations that the Navy will not be drilling in the areas under the actual tanks.

BWS Comment #7:

Section 2.6.2 Managing Decision Error states that errors in ensuring installation of vertical monitoring wells will be minimized by levelling the drilling rig at least twice per day during drilling. The level of the drill rig is not the only factor important to ensure drilling a "vertical" borehole. Other factors include bottom-hole weight (bottom-hole drill assembly) and rate of advance, which together should be balanced so the drill bit doesn't deflect as it encounters various basaltic intraflow structures. To accurately determine if each borehole is vertical, the driller should stop and trip-out of the hole and run a gyroscopic alignment survey once a day during drilling.

EPA Response:

The Regulatory Agencies agree with this comment and have already addressed this issue in their comments. The BWS comment provides more detail and will be incorporated into the Regulatory Agencies' comment letter.

BWS Comment #8:

Section 2.7 Step 7-Develop Plan for Obtaining Data repeats the statement that the proposed well locations will provide information about " ... the nature and extent of LNAPL ... within the vadose zone ... ". This sentence and all other text should be revised to either 1) explain that the proposed well locations are likely to provide information about LNAPL nature and extent in the vadose zone only if the fuel has migrated long distances laterally or 2) add borings nearer to the tanks that will be much more likely to be useful in mapping out LNAPL nature and extent in the vadose zone.

EPA Response:

As stated previously, this plan is for installing monitoring wells, it is not for developing the conceptual site model. The MWIWP in this section clearly states, (but the BWS comment does not include) that one reason the proposed well locations were chosen was to "evaluate the nature and extent of LNAPL and dissolved COPCs that may be present within the vadose zone and groundwater underlying and downgradient of the site."

BWS Comment #9:

Section 3.1 Monitoring Well Locations provides the reasons underlying proposed choices. None of the reasons include providing information about the nature, extent, and migration of LNAPL within the vadose zone cited in Sections 2.2 and 2.7. Please revise all sections to be consistent about the objectives and how the proposed monitoring wells will achieve those objectives.

EPA Response:

The BWS is misinterpreting the purpose of this workplan. It is not primarily designed to characterize contamination in the vadose zone but is for the installation of monitoring wells. Information collected during the well installation can be used in developing the conceptual site model but the complete plan for addressing this BWS comment will be part of the Section 6 & 7 Scope of Work.

BWS Comment #10:

The second paragraph of Section 3.1 states that "The number of locations proposed in the vicinity of the underground storage tanks (USTs) was limited due to the lack of exposure pathways and to minimize the creation of migration pathways between possible vadose zone contamination and the groundwater aquifer." This statement is both misleading and incorrect. None of the proposed locations are in the "vicinity of the USTs"; this incorrect statement should be revised to eliminate the factual error.

EPA Response:

The term "vicinity" is defined as "the quality or state of being near" and "a surrounding area or district". The Regulatory Agencies believe the MWIWP's use of this term is appropriate. Had the MWIWP stated "in the immediate vicinity..." that would be incorrect.

BWS Comment #11:

Figure 3 depictions of the assumed width and depth of the valley fill and saprolite in the North and South Halawa valleys do not take into account all available data; thus are misleading and could lead to incorrect choices for proposed well locations.

EPA Response:

The geologic cross section provided by BWS as Figure 1 seems to show that the proposed location of RHMW11 will not intercept the valley fill, which is one of the main reasons for choosing its location. The Regulatory Agencies will need to have a geologist weigh in on this comment.

BWS Comment #12:

The proposed monitoring well Red Hill Monitoring Well (RHMW) 09 location is in very close proximity to a monitoring well being planned to be installed by the BWS. We recommend re-locating RHMW09 to the south side of Halawa Valley, along South Halawa stream, within the Red Hill Bulk Fuel facility boundary, such as the location shown in the enclosed Figure 2.

EPA Response:

The Navy prefers to use their own wells for monitoring any potential contaminant migration rather than relying on wells owned by other organizations. Furthermore, the proposed alternative location suggested by BWS appears redundant since there are already three monitoring wells in that area.

BWS Comment #13:

Figure 3 shows that the proposed monitoring well RHMW11 intersects the western part of the exaggerated width for valley fill in South Halawa valley. Based on the available data, physical visits to this area, and reports cited above, this proposed well is more likely to intersect Koolau basalt than South Halawa valley fill. Consequently, the proposed location should be reconsidered using the recommended revised Figure 3. Installing the monitoring well on the east side of South Halawa Valley closer to South Halawa stream will provide a better understanding of any head changes caused by valley fill.

EPA Response:

The Navy should carefully consider this BWS comment to ensure that the proposed location of RHMW11 achieves the purpose for which it was intended.

BWS Comment #14:

At present Figure 3 only shows a combined valley fill and saprolite unit. What are the other units and where do they occur?

EPA Response:

EPA assumes that figure 3 was included in the MWIWP to illustrate the rationale for the monitoring well locations chosen by the Navy. It is not intended to be a final depiction of geology of the area.

BWS Comment #15:

The BWS Halawa Shaft is projected into the valley fill in Figure 3 which is factually incorrect. Figure 3 should be revised to show that the shaft is northwest of the valley fill in North Halawa valley as shown in cross-section A-A on Plate 1 in Izuka (1992). A perpendicular projection of the dot representing the shaft in the inset to Figure 3 still places the shaft outside of the valley fill to the west or northwest. The current placement and depiction of a well instead of a shaft are likely to only confuse readers. Figure 3 presently appears to imply that Halawa shaft can actually withdraw large amounts of water (6 to 10 million gallons per day) from the valley fill.

EPA Response:

The Regulatory Agencies also noted that the depiction of the Halawa Shaft Well may be inaccurate. The Navy should consider this comment from BWS and revise Figure 3 accordingly.

BWS Comment #16:

Given that the North and South Halawa valley fill units were created by incision by meandering streams and later backfilling, defining the width and depth of these units will require more than a single new monitoring well in the Halawa valley area.

EPA Response:

The Parties to the AOC have agreed that the development of the conceptual site model and conducting groundwater modeling will be an iterative process. An initial investigation of the nature and extent of the Halawa Valley fill will begin with the installation of a single well. Depending on the information gathered from that effort, additional borings in that portion of the study area may be needed.

BWS Comment #17:

The title for Figure 4 states that it is a geological cross-section. However, it does not show any geology and should instead be characterized as a schematic or longitudinal profile.

EPA Response:

The Regulatory Agencies agree with the BWS comment.

BWS Comment #18:

There are significant differences between the text descriptions of the monitoring well construction requirements and those shown on Figure 5. For example, the text does not specify what type of grout should be used for the conductor casing, but in Appendix A, Procedure I-C-1 indicates that it should be cement grout like that indicated on Figure 5. None of these text sections, nor Appendix A, Procedure I-C-1, provide specifics with regards to how the cement grout seal will be emplaced in the annulus. This is a significant concern since improper placement of the cement grout within the annulus between the conductor casing and the borehole can create open voids within the annulus and provide a potential vertical pathway for contaminate movement. Given the number of monitoring wells that the Navy has constructed, it is expected that the Navy should have specific plans and procedures for this critical aspect of monitoring well construction.

EPA Response:

The Hawaii DOH Technical Guidance Manual provides some more specificity on the installation of the annular seal and conductor casing. The MWIWP attachment I-B-1-1, section 5.6 does provide some details on the well installation, but seems to allow some flexibility on the ultimate choice of methods for installing the annular seals. The HDOH TGM requires the installation plan to provide installation details for the placement of filter packs and slurry seals, however the MWIWP does provide these details. The level of detail the BWS thinks should be included is not clear from their comment.

BWS Comment #19:

Below the bottom of the conductor casing the specified grout used to create the seal changes from the far more effective cement to the less effective bentonite. Figure 5 indicates that bentonite chips will be used for a seal in the portion of the borehole hole (potentially spanning more than 200 feet of annulus) from the bottom of the conductor casing to the top of the filter pack. It would be extremely difficult to emplace dry bentonite chips over such a very long interval and achieve a proper seal between the well casing and borehole wall. Such problems likely to be encountered using dry bentonite chips is "bridging" (leaving gaps). Also after the bentonite chips are emplaced they have to be hydrated (to achieve a seal) by adding water to the borehole. However, any bridging within the emplaced bentonite chips will also likely cause incomplete hydration of the bentonite chips and result in a defective bentonite seal.

EPA Response:

The DOH TGM seems to allow for either the use of bentonite chips or a bentonite grout/slurry. DOH should consult with a drilling expert to determine whether there is a preference for methods to grout the conductor casing.

BWS Comment #20:

The in-well hydration of the dry bentonite chips calls for the introduction of non-formational water to be introduced into the basalt vadose zone which could potentially mobilize contaminants, if present. A better approach would be to use cement grout slurry, or even a bentonite slurry (allowed for in Section 4.3.4, lines 6 17) and emplace it using a tremie pipe for this portion of the well seal.

EPA Response:

If the concern expressed by BWS is valid, it would seem that the choice of dry bentonite chips versus using a premixed slurry would depend on whether contamination is encountered during drilling. If no contaminants are present, then the concern is unwarranted.

BWS Comment #21:

The text sections of this work plan cite American Society for Testing and Materials (ASTM) standards for logging core. The ASTM standard contains generic descriptions and procedures that are of little general usefulness for logging basaltic core for a hydrogeologic/environmental assessment project -like this project. The work plan doesn't contain any details concerning how the various important basalt intraflow structures (e.g., flow top breccias (clinker sub-types), accretionary lava clasts, simple vesicular flow tops, vesicular flow lobes, inflated pahoehoe lobes, spatter-fed pahoehoe lobes, lava tubes, a'a columnar dense interiors, flow-bottom breccias, normal flow bottoms, flow levees, tumuli, rootless spatter cones, etc.) will be included in the descriptive and photo logs or how to recognize and identify the difference between tectonic fractures, primary cooling joints, and drilling-induced fractures. Additionally, the text sections of the work plan fail to provide any direction, guidance, or procedures for how basaltic core should be photographically documented, preserved, and archived other than the generic

recommendations from in the ASTM standards. The MWIWP should be revised to state that all cores from new monitoring wells, as well as, cores from existing wells should be logged to note these important intraflow structures, tectonic fractures, primary cooling joints, and drilling-induced fractures.

EPA Response:

BWS is correct in that the MWIWP does not specifically mention that the specific geologic conditions included in their comment. However, is it necessary for the MWIWP to be that specific? The MWIWP at 4-5, lines 1 – 8 states that the coring logs “will note rock-quality designation; rock color; texture; strength; degree and orientation of fracturing; shape, size and volume of voids; weathering; and secondary staining or mineralization.” This seems to imply that the Navy contractors will note many of the features listed by the BWS comment.

BWS Comment #22:

The proposed [Log boring] procedure fails to provide specifics for identifying and describing basalt intraflow structures. The MWIWP should be revised to provide guidelines for identifying, characterizing, and logging these key features.

EPA Response:

As stated in the previous responses, many of the deficiencies described by BWS seem more applicable to a conceptual site model workplan.

BWS Comment #23:

The MWIWP should be revised to state that all logs, photo logs, and cores from existing and new wells will be made available for inspection on request by Subject Matter Experts and their contractors.

EPA Response:

We can request that the Navy include all logs and photo logs of the coring work in a subsequent submittal and request that they archive the cores so they are available for future inspection if necessary.